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Enhancing Transportation Safety And Efficiency Through Societal Intelligence

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ABSTRACT

In recent years, our transportation system has seen significant changes because of increasingly intelligent infrastructure and cars. The transportation system is thought to be quite heterogeneous, made up of a variety of different actors with various levels of connectedness and intelligence. The most intelligent and connected of them all, autonomous cars have the potential to significantly improve the effectiveness and dependability of the transportation system. The general transportation system does not actively support autonomous driving, however, as the current design of autonomous driving approaches focuses primarily on the autonomous car at the individual level. In fact, by utilizing the growing intelligence and connection in transportation, the security and effectiveness of both individual vehicles and the system might be greatly increased. Vehicles must communicate and work together with one another, as well as with the infrastructure and management of the transportation system, to make this possible. We suggest the social intelligence (SI) framework in this essay. Unlike the multientity intelligence frameworks now in use, SI allows for far more varied interactions between the many entities at various levels and is thus appropriate for transportation. We also divide the driving procedure into four functional layers and show how the social intelligence framework may be customized to each layer.

1. INTRODUCTION

Our transportation networks have seen dramatic changes in recent years. On the one hand, the era of intelligent transportation systems is introduced as intelligent capabilities are incorporated into various system components at different levels, including the infrastructure and the vehicular players in transportation (ITS). On the other hand, connectivity is provided through vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), vehicle-to-everything (V2X), and internet of vehicles (IoV) networking to enable information exchange and collaborations among the system's users. The ITS is moving toward automated and worldwide control because of the intelligence being dispersed throughout the entire system and the connection tying together key components. It is anticipated that the system's overall safety would increase and that it will evolve more healthily. The transportation system's dependability and efficiency will both increase. Autonomous driving stands out among the innovative ITS components and methodologies. The fully intelligent autonomous vehicles are expected to operate effectively and safely behind the wheel without assistance from a human. The integration of autonomous vehicles into our current transportation system has several advantages, including increased safety, reduced traffic, better parking conditions, more effective use of transportation resources, improved commuter experiences, and so on. Even though the first autonomous vehicle prototype was created in the 1980s, research on driverless cars began in the 1920s. Due to the outdated hardware technology, they did not start drawing notice from the public until a little more than ten years ago. Numerous supporting technologies, including sensing technology, high-performance computing, artificial intelligence, computer vision, wireless communications, and networking, have made enormous strides in the last ten years. These indicate a bright future for autonomous driverless cars. The development of autonomous vehicles and their widespread acceptance in everyday life have been prioritized. Today, numerous research institutions and businesses from around the world have already started testing driverless autonomous vehicles on public roads. In the US, numerous states have approved the use of autonomous vehicles in their public transportation systems, and numerous businesses, like Uber, Google, and others, are putting their driverless car fleets into service.

2. OBJECTIVE

Similar systems comprising diverse entities with both local and global interests can also use the proposed

SI framework. The proposed SI framework can also be used to describe how different actors interact in power systems when they share the same grid infrastructure but act according to distinct motivations.

2.1 PROBLEM STATEMENT

Transporting people or things from one location to another securely and effectively is the transportation system's main goal. While both individual vehicles and the entire transportation system share a commitment to safety, efficiency can mean very different things to different people depending on their point of view. Subject to the assumption that the driving process is safe, driving decisions for specific cars are often based on the time efficiency, fuel efficiency, and occasionally toll efficiency. The decisions made while driving is multilateral and range from those that are relatively more global, like when to travel and which route to take, to those that are relatively more local, like the speed at which one is travelling, when to change lanes, when to pass, when to refuel or charge, when to park, etc. While this is going on, the broader transportation system is more focused on maintaining good road conditions, reducing congestion, and reducing pollution. To accomplish these goals, the transportation planning and management can take the necessary steps. Like individual vehicle activities, system-level actions can also be divided into relatively global and relatively local actions, such as real-time transportation intervention via dynamic road/lane traffic control, dynamic tolling, etc. It is obvious that the goals of the entire transportation system and those of specific vehicles cannot be entirely aligned. In some cases, one may even discover those contradicting one another. However, because cars and trucks dominate the road transportation system, these goals necessarily overlap and interact. A real-time transportation intervention, for instance, can only be effective when individual vehicles react appropriately. For instance, road planning and transportation laws are created based on the aggregated behavior of individual vehicle driving decisions. Of course, decisions about how to organise and manage transportation also have a big impact on how people choose to drive.

2.2 EXISTING SYSTEM

In the current system Despite the fact that there are several multi entity intelligence frameworks that describe the application of intelligence with collaboration among many participants, none of them were able to capture the special characteristics for the cooperation among autonomous cars. The performance of the entire system is the only thing that matters to entities operating in the frameworks that are already in place.

Disadvantage of Existing System

- Less exact. Small Security
- Low parking standards
- Inadequate use of the transportation infrastructure

2.3 PROPOSED SYSTEM

The current design of autonomous driving approaches in the proposed system is primarily focused on the autonomous vehicle at the individual level, and the larger transportation network does not actively support autonomous driving. Autonomous driving stands out among the innovative ITS components and methodologies. The fully intelligent autonomous vehicles are expected to operate effectively and safely behind the wheel without assistance from a human. The integration of autonomous vehicles into our current transportation system has a number of advantages, including increased safety, reduced traffic, better parking conditions, more effective use of transportation resources, improved commuter experiences, and so on.

3. METHODOLOGY OF PROJECT

As was mentioned in the section before, the transportation system and all of its users in this chapter must meet their individual goals for efficiency and safety. It is only logical to consider the possibilities of utilizing multientity intelligence in transportation given the pervasive deployment of intelligence and connectivity among the participants. Several technologies along this line are described in the literature currently in print. Next, we'll talk about those and see if they can be transported.

MODULES NAME:

- Collective Intelligence
- Collaborative Intelligence
- Feasibility for Transportation

MODULE DESCRIPTION:

Collective Intelligence:

Collective intelligence, also referred to as "swarm intelligence," is a term used to characterise the cooperative efforts of the intelligent evolution for a group. According to this structure, each member of a group collaborates on a task to achieve one or more overall goals. Individuals are anonymous and without any personal preferences, goals, or interests. The entire team tries to come to an agreement. To put it another way, the process of collective intelligence is homogeneous. The designated global collaboration with established rules provided by the system control centre is the primary means of contact amongst the intelligent entities within this framework. The collaboration of unmanned aerial vehicles (UAVs) to complete a task as a group is an example of collective intelligence. The achievement of the group task serves as a gauge of collective intelligence performance. Individual UAVs work together according to a predetermined collaboration protocol. It doesn't matter which entities contribute more than others, which ones have evolved into more intelligent beings, or which ones play more crucial roles in achieving the system task, if doing so is advantageous to the system. Under extreme circumstances, even an individual's survival can be sacrificed if the group requires it. An example of the components and interactions found in a system of collective intelligence.

Collaborative Intelligence:

The phrase "collective intelligence" is occasionally used synonymously with "collaborative intelligence." There are some little but significant distinctions between the two, though. Particularly, entities taking part in the framework for shared intelligence are not required to be anonymous. In other words, each person can have unique characteristics and a different level of intellect, and there is usually some degree of heterogeneity among the participants: some may be stronger than others, some may be weaker, and some may contribute more than others. The ultimate objective is still to do some cooperative tasks, much like collective intelligence. People do not have their own self-serving interests or goals. Coordinated worldwide collaboration under the direction of the system control centre could be used to describe how different intelligent entities communicate with one another. A good example of this is crowdsourcing, in which the system asks a group of users for information about a particular occurrence, and each user contributes their information in accordance with their own (sometimes disparate) capabilities. According to this architecture, the participants may be able to contribute to the overall system in different ways depending on the circumstances, and the system centre monitors the health of each participant while coordinating collaboration among them to increase system efficiency. Each entity is motivated in the same way to contribute to the overall system and always complies with orders given by the system control centre. An example of the components and interactions found in a system of collective intelligence.

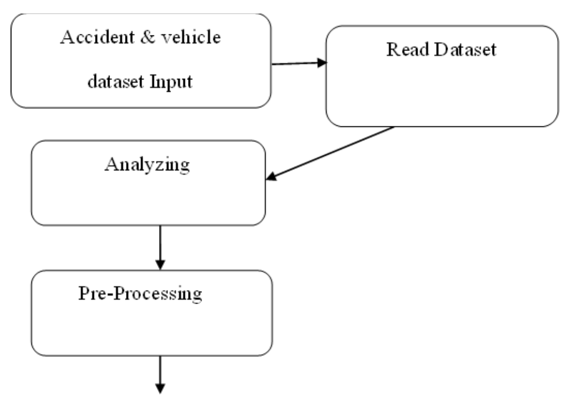
Feasibility for Transportation:

Evidently, the only components of existing multientity intelligence systems are group objectives and tasks. Even while individual participant skills, functions, and geography may be handled to varying degrees in these frameworks, individual participant preferences, interests, and intentions are completely ignored. With transportation networks, the situation is significantly different. The ultimate purpose of transportation is to as effectively fulfil each traveler's objectives for safety and efficiency. The system-level safety and efficiency goals of transportation can be advanced by the participants working together, but these actions are meant to enhance the system's capacity to support the participants. The human goals are the primary consideration in transportation, whereas the system goals are secondary and supportive. Because of this, none of the multientity intelligence frameworks in use today are enough to meet the needs of our evolving transportation system.

4. ALGORITHM USED IN PROJECT

Its application to ITS has been described in terms of the four different functional modules of ITS, together with the difficulties and opportunities involved. Similar systems comprising diverse entities with both local and global interests can also use the proposed SI framework. We first segment the driving process into four layered modules, each with specific functions according to the goals to complete the driving tasks and information processed and produced, to guide the implementation of the SI application and implementation in ITS. Layers: Setting Up the Scene, Determining the Situation, Planning and Scheduling, and Online Operation and Control.

6. DATA FLOW DIAGRAM



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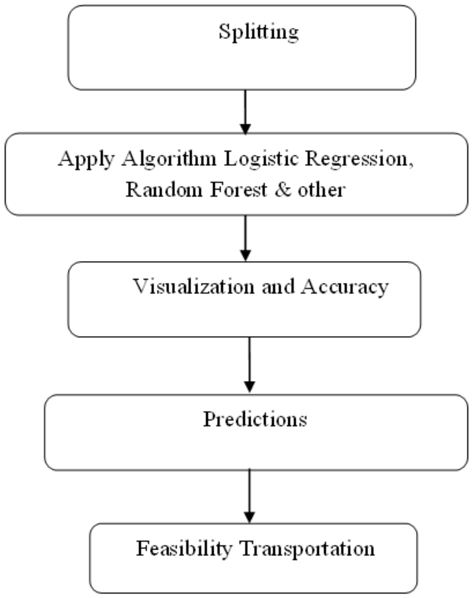


Fig: Flow Diagram

7. SYSTEM ARCHITECTURE

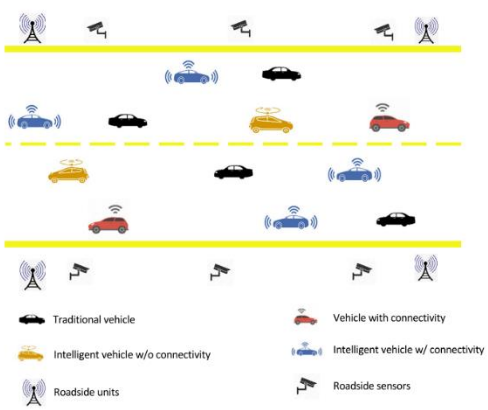
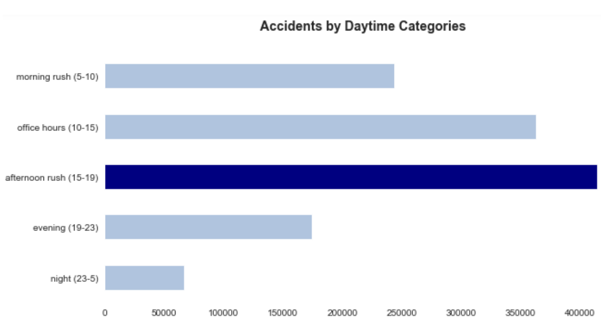
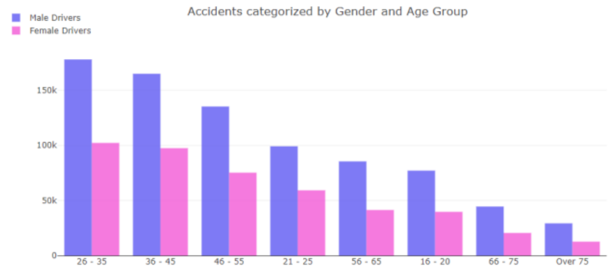
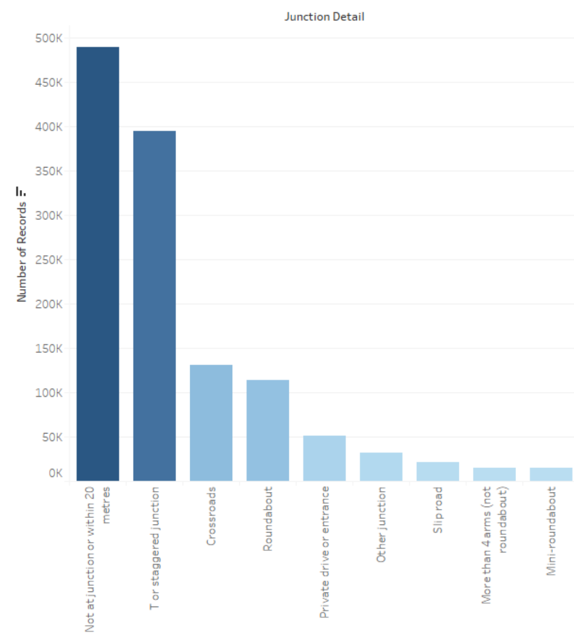


Fig: SYSTEM ARCHITECTURE OF PROJECT

8. RESULTS








```
RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
            max_depth=None, max_features='auto', max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, n_estimators=10, n_jobs=1,
            oob_score=False, random_state=None, verbose=0,
            warm_start=False)
```

```
# Predict on testing set
pred_y_8 = clf_8.predict(X_validation_PC)
```

```
print(accuracy_score(Y_validation, pred_y_8))
```

```
0.8431072008828668
```

```
LogisticRegression(C=100.0, class_weight=None, dual=False, fit_intercept=True,
          intercept_scaling=1, max_iter=2500, multi_class='ovr', n_jobs=1,
          penalty='l2', random_state=None, solver='saga', tol=0.0001,
          verbose=0, warm_start=False)
```

```
pred_y_15 = clf_15.predict(X_test)
```

```
print(accuracy_score(y_test, pred_y_15))
```

```
0.8045124306428374
```

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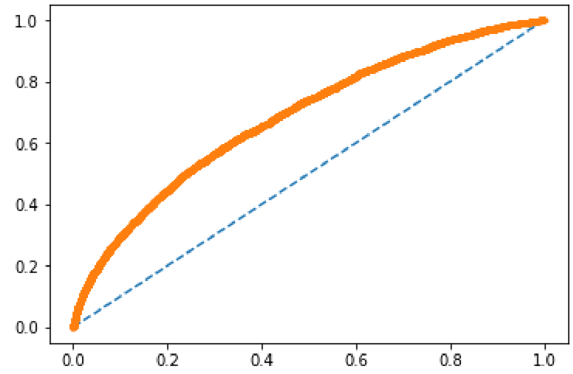

	AUC	MCC	accuracy	f_measure	kappa_score	precision	recall	specificity
LR_No_Tuning	0.5994	0.2007	0.8061	0.3135	0.2007	0.3169	0.3101	0.8887
LR_with_Tuning	0.6009	0.2017	0.8045	0.3157	0.2017	0.3155	0.3159	0.8859

	AUC	MCC	accuracy	f_measure	kappa_score	precision	recall	specificity
RF_No_Tuning	0.5378	0.1395	0.8491	0.1620	0.1093	0.3905	0.1022	0.9734
RF_with_Tuning	0.5626	0.1799	0.8426	0.2365	0.1630	0.3846	0.1707	0.9545

9. FUTURE ENHANCEMENT

In our future work, there will be rivalry for scarce resources like highway lanes, right-of-way, more affordable, quicker, or conveniently located gas stations, etc. Keep in mind that in the multientity systems we have just seen, such competing interactions have never occurred. Cooperation is another facet of these exchanges, even if it is natural and implied in traditional transportation. Travel safety can only be ensured by individual transportation participants working together. These interactions take place both at the level of the individual participant, as when drivers check their blind spots and occasionally slow down to yield on multilane highways, and at the level of the system, as when traffic lights, stop/yield signs, and laws and regulations are implemented. It is expected that these interactions and interventions will be upgraded in terms of both quality and quantity because of the rising levels of intelligence and connectedness.

10. CONCLUSION

In this paper, we have presented a novel multientity intelligence framework known as the SI for vehicle players in ITS with mixed intelligence and connectivity. In-depth discussion has been had regarding the characteristics of the SI and the distinctive interactions between entities under the SI framework. Its application to ITS has been described in terms of the four different functional modules of ITS, together with the difficulties and opportunities present therein. Similar systems comprising diverse entities with both local and global interests can also use the proposed SI framework. The suggested SI framework, for instance, can be used to describe how various actors interact in power systems where they all share the same grid infrastructure but act according to their own incentives.

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